

US-PAT-NO: 6553070

DOCUMENT-IDENTIFIER: US 6553070 B2

TITLE: Video-data encoder and recording media wherein a video-data encode program is recorded

----- KWIC -----

Brief Summary Text - BSTX (25):

Further, in an embodiment of the invention, where the encoding is performed according to the MPEG standard, the watermark data are embedded into one or some of macro-blocks determined referring to a criterion defined in connection with anyone of a slice, a picture, a field, a frame, or a GOP.

Detailed Description Text - DETX (3):

FIG. 1 is a block diagram illustrating a first embodiment of the invention, wherein a video-data encoder 100 according to the embodiment comprises; a DCT processor 101 for performing Discrete Cosine Transform of an original image data stream 110 wherein electronic watermark data 102 are to be embedded, a

Details Text Image HTML KWIC

2 US 6567534 B1

3 US 6563936 B2

4 US 6553070 B2

5 US 6530021 B1

6,246,802 B1 • 6/2001 Fujihara et al. 382/276

FOREIGN PATENT DOCUMENTS

DE 4430864 3/1996
P 5-241403 5/1996

8 Claims, 5 D

Hidenori Nakazawa, et al., "A
ing on MPEG2 Videos for Co
SCIS 97-31D, Jan. 1997, col
Coding and Information Secu
Hiroshi Ogawa, "A Copyri
Method Using DCT for Digi
97-31G, Jan. 1997, collection
and Information Security Sys
Adrian G. Bors et al, "Water
Constraints", Proceedings of
ference on Image Processing,
231-234.

Frank Hartung et al. "digit
Compressed Video", Procee
1996, pp. 205-213.

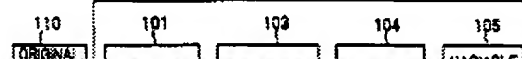
* cited by examiner

Primary Examiner—Chris Ke
Assistant Examiner—Allen W
(74) Attorney, Agent, or Firm

(57)

ABST

To provide an apparatus for
according to the frequency-d
video data, a video-data enc
forming encoding of an orig
pressed data stream having
prises; means (101) for trans
into a sequence of processin
data; means (103) for embed
data into at least one unit o
units; and means (104 and 1
pressed data stream by proces
ing units. Therefore, the data
video data into the frequency
water-mark data can be ped
additional process, by exploit
encoding the original video t
stream.



TITLE Methods and systems for watermark processing of line art images

----- KWIC -----

Brief Summary Text - BSTX (9):

Most of the prior art in image watermarking has focused on pixelated imagery (e.g. bit-mapped images, JPEG/MPEG imagery, VGA/SVGA display devices, etc.). In most watermarking techniques, the luminance or color values of component pixels are slightly changed to effect subliminal encoding of binary data through the image. (This encoding can be done directly in the pixel domain, or in another domain, such as the DCT domain.) In some systems, isolated pixels are changed in accordance with one or more bits of the binary data; in others, plural domain-related groupings of pixels (e.g. locally adjoining, or corresponding to a given DCT component) are so changed. In all cases, however, pixels have served as the ultimate carriers of the embedded data.

tin, OR

term of this
under 35

iminal dis-

on May 6,
ination in-
ay 8, 1995,

on Apr. 16,

104K 1/00
0, 382/135
2/100, 135,
2, 287, 51,
901, 902

283/70
355/231

Grubi et al., "Informa-
terfeller," *Proc. 2nd*
Apr. 14-17, 1998, p.

Boland, "Watermark
tection," *Fifth Intern.*
Its Applications, Co

Grubi, "Information
falter," *Proc. 2d Int.*
1525, pp. 1-15, Apr.

* cited by examiner

Primary Examiner
(74) Attorney, Age
Digimarc Corporatio

(57)

Binary data is emb-
lateral recovery by, an
encounter banknote
scanners, and print
providing nominal li
virtual grid of point
regions. The lumina
changed to effect a
nance may be cha
spacing of the artwor
the artwork.

8 Cls

Details Text Image HTML KWIC

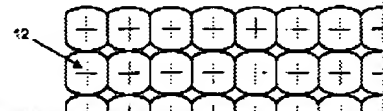
2 US 6567534 B1

3 US 6563936 B2

4 US 6553070 B2

5 US 6530021 B1

5,258,814 A	• 11/1998	Antoni	382/115
5,843,564 A	• 12/1998	Gasper et al.	428/211
6,081,345 A	• 6/2000	Curry	358/19
6,086,706 A	• 7/2000	Bressan et al.	156/277
6,104,812 A	• 8/2000	Koltai et al.	380/51



registration and calibration

----- KWIC -----

Detail Description Paragraph - DETX (24):

[0048] Furthermore, the system of the present invention has means for a user interface for all phases of the invention. A user may select, among other things, which images are to be registered, and at what arbitrary image plane. The user interface, suitable for display on a computer monitor and with input from a keyboard, mouse pointer, or other I/O device, has fields for any and all internal and external parameters of the projection matrix of the images, including aspect ratio, number of rows of images, the tilt between rows, the angle between photos within a row, the roll of each image taken (e.g., landscape mode), as well as fields for how many horizontal rows of images are to be registered (typically two or more), image center position, focal length of camera, camera orientation with respect to a common reference frame, such as camera pan, tilt, roll and skew, and the brightness and contrast of images. The user interface may have the ability to adjust the aforementioned parameters for each image individually, or may have the ability to adjust parameters for images captured with a particular methodology, such as equal angular increments in latitude and longitude.

up to several views or systems. In a preferred embodiment, images taken from a plurality of cameras are registered with one another, and locally optimized objective function (local error) is used to construct a quadratic surface optimization function (global error) is used to avoid the direct evaluation of the objective function, saving computation. The blending aspect of the improved procedure is described that relates to Gaussian pyramids, using a blend mask determined by the Gaussian transform procedure is disclosed for the pyramid results in low frequency image blended over a wider region and high frequency image blended over a narrower region. Input is also provided to allow for initial calibration and feed-back photos and convergence of the system.

START:
AD IN OVERLAPPING
IMAGES I, J

SIZE PARAMETERS USED
PAIRWISE OBJ. FUNC.

FIND LOWEST LEVEL IN
GAUSSIAN PYRAMID

ESTIMATE AND ADJUST
PARAMETERS OF PROJECTIVE
REGISTRATION MATRIX
 a_{ij} , b_{ij}

9	US 20020145660 A1
10	US 20020114536 A1
11	US 20020113756 A1
12	US 20020105484 A1

DOCUMENT-IDENTIFIER: US 20030044073 A1

TITLE: Image recognition/reproduction method and apparatus

----- KWIC -----

Summary of Invention Paragraph - BSTX (12):

[0010] Further, in order to obtain a more detailed three-dimensional model relating to the object of interest, there is a need for detection measurement as by a technique for obtaining the shape model image acquired by shape measuring means or by binocular stereo. As a result, computation costs are high and processing requires a period of time.

Details Text Images HTML KWIC

13 US 20030067462 A1

14 US 20030058240 A1

15 US 20030044073 A1

16 US 20030038801 A1



US 20030044073 A1

(51) United States

(52) Patent Application Publication (53) Pub. No.: US 2003/0044073 A1

Matsugu et al.

(54) Pub. Date:

Mar. 6, 2003

(56) IMAGE RECOGNITION/REPRODUCTION METHOD AND APPARATUS

(57) Foreign Application Priority Data

Feb. 2, 1994 (JP) 1994-010005
Mar. 23, 1994 (JP) 1994-010006(58) Inventors: Masaharu Matsugu, Chiba-ken (JP);
Reiharu Ichino, Tokyo (JP)

Publication Classification

Correspondence Address:
MORGAN & EDENBAGAN, L.L.P.
940 Park Avenue
New York, NY 10146-0049 (US)(59) Int. Cl.⁷ G06K 1/34; G06K 5/44;
G06K 9/40; G06K 9/42
(60) U.S. Cl. 382109; 382301; 382179

(61) Appl. No.: 10364342

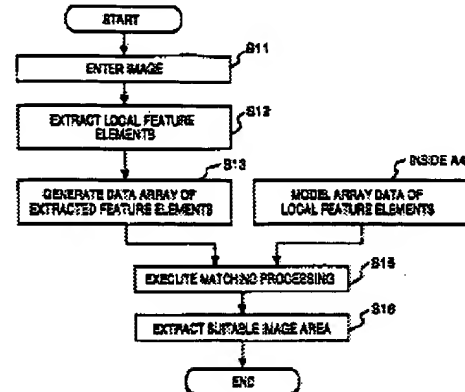
(62) Filed: Oct. 1, 2003

Related U.S. Application Data

(63) Continuation of application No. 2001/010005, filed on Jul. 18, 2001, now Pat. No. 6,443,174, which is a continuation of application No. 09/543,717, filed on Feb. 2, 2000, now abandoned.

ABSTRACT

An image recognition/reproduction method includes an execution step of extracting local feature elements of an image and a selection step of selecting a pair composed of a prescribed local feature element and position information information thereof, this pair being data that the display represents a pair composed of a prescribed local feature element and position information information thereof and a pair composed of a local feature element extracted at the execution step and position information information thereof is less than a prescribed distance.



DOCUMENT-IDENTIFIER: US 20020060686 A1

TITLE: Texture information assignment method, object extraction method, three-dimensional model generating method, and apparatus thereof

----- KWIC -----

Summary of Invention Paragraph - BSTX (9):

[0007] According to this three-dimensional model construction apparatus, an object of interest that is rotated on a turntable is continuously shot by a camera. The silhouette image of the object of interest is extracted from the obtained image by an image processing computer. By measuring the horizontal distance from the contour of the silhouette image to the vertical axis of rotation for the silhouette image, a three-dimensional model is generated according to this horizontal distance and the angle of rotation. More specifically, the contour of the object of interest is extracted from the continuously shot silhouette images to be displayed as a three-dimensional model.

3 12, 1997 (JP)
5 12, 1997 (JP)

Publication Classification

Int. CL.
U.S. CL.

ABSTRACT

present method represents a three-dimensional by polygons according to a plurality of information picked up by rotating a real object every angle to assign texture information on from object image information having the an area of the relevant polygon. In order to continuity between adjacent polygons, information having correspondence between of interest and an adjacent polygon thereof be the object image information approximating position and the shooting direction. And divides an object image into a plurality of difference between an object image and image in region level, outputs a mean value value of difference in the region level, region having the mean value of absolute value equal to or greater than a threshold portion. Another further method obtains a images by shooting only a background of and by shooting the object of interest on. A silhouette image is generated by difference process between the object image and image. A voting process is carried out on the basis of the silhouette image. A raised according to the three-dimensional shape voting process. The texture obtained from is mapped to the polygon.

Details Text Image HTML KWIC

48 US 20020061123 A1

49 US 20020060686 A1

50 US 20020056120 A1

51 US 20020047835 A1

SILHOUETTE IMAGE PRODUCTION S12

VOTING PROCESS S14

POLYGON REPRODUCTION S16

US-PAT-NO: 6597406

DOCUMENT-IDENTIFIER: US 6597406 B2

TITLE: System for enhancing a video presentation of a live event

----- KWIC -----

Detailed Description Text - DETX (102):

In the disclosed embodiment, cameras 60, 62 and 64 are each modeled as a 4.times.4 matrix which includes two parts—a fixed transformation (X) which represents the position of the camera in the stadium and its orientation, and a variable transformation (V) which varies with changes in pan angle, tilt angle and the zoom: ■

Detailed Description Text - DETX (103):

The fixed transformation matrix (X) models x, y, z position as well as fixed yaw, pitch and roll representing the camera's mount orientation:

Details Text Image HTML KWIC

20 US 20010005218 A1

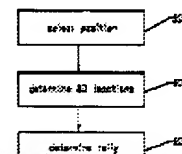
21 US 6597818 B2

22 US 6597406 B2

23 US 6549651 B2

598, 599, 600, 706; H04N 5/265, 5/272,
5/268, 5/275

85 Claims, 25 Drawing



3,973,239 A 8/1976 Kakumoto

(List continued on next)

FOREIGN PATENT DOCU

41 01 156 A1 1/1991

1659078 A1 6/1991

WO93/02524 2/1993

(List continued on next)

OTHER PUBLICATION

May 2000—The Ultimate Workstation
re and Producers, Grad Hi-Tec Sys
Track, GPS Tracking System for
adcast Coverage of the America's
Track Technical Overview, 1992.*
Viz Software Documentation, 1992.

Primary Examiner—David E. Harvey
Attorney, Agent, or Firm—Visi-
mon & DeNiro LLP

ABSTRACT

A three-dimensional model is created
to be captured on video. A camera
and/or zoom sensors. An operator sel
environment. The three-dimensional mo
the three-dimensional coordina
ected by the operator. Information
for zoom sensors is used to tr
dimensional coordinates to a two-dim
video from the camera. Using t
tion of the video, a graphic is pr
eo such that the graphic appears
ation in the environment.

into a warped sequence of distinct and stationary scene changes each corresponding to a speaker slide, wherein each scene change is of an associated subset of the image frames. A key frame is generated for each scene change representative of the associated subset. Each key frame is compared with the associated subset for identifying image frames with desired affordances such as semantically significant speaker gestures or pointing. The condensed version of the video is compiled as an annotated video comprising the key frames and the frames with the desired affordance. In the condensed version of the video, redundant image frames and nuisance variations can be deleted from the video sequence so that the digest is a much more compact and concise version of the technical talk. Lastly, the condensed version is converted to a time or an audio for a useful representation of the talk.

Claims Text - CLTX (1):

1. A method for generating a condensed version of a video sequence for publication as an annotated video comprising steps of: storing the video sequence as a set of image frames; stabilizing the image frame sequence of distinct and stationary scene changes wherein each scene change is comprised of an associated subset of the image frames; generating a template image frame from the associated subset; filtering of the associated subset and matching the template in one of the associated subset, wherein the closest one comprises

U.S. Patent

May 6, 2003

Sheet 1 of 3

US 6,560,281 B1

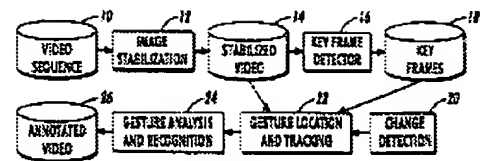


FIG. 1

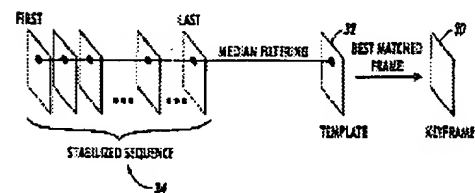


FIG. 2

Details Text Image HTML KWIC

13 US 6560281 B1

14 US 6542773 B2

15 US 6452615 B1

16 US 6424989 B1

US-PAT-NO: 6389311

DOCUMENT-IDENTIFIER: US 6389311 B1

TITLE: Systems and methods using annotated images for controlling the use of diagnostic or therapeutic instruments in interior body regions

----- KWIC -----

Detailed Description Text - DETX (197):

When the CREATE control button 430 is selected, the application A4 freezes the real-time image 416 (or a prescribed sequence of video images 416) so that it can be grabbed for processing. When the EDIT control button 438 is selected, the operator can mark or annotate the grabbed image or video image sequence with comments, in the same manner permitted by the INS MARKER button 390 of application A3, which has been previously described (see FIG. 19).



Patent No.: US 6,389,311 B1
Date of Patent: May 14, 2001

REFERENCE CITED**U.S. PATENT DOCUMENTS**

15 A * 47593 Karpis et al. 6/25/90 675,903
16 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
17 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
18 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
19 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
20 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
21 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
22 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
23 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
24 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
25 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
26 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
27 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
28 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
29 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
30 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
31 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
32 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
33 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
34 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
35 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
36 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
37 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
38 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
39 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
40 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
41 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
42 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
43 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
44 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
45 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
46 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
47 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
48 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
49 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
50 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
51 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
52 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
53 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
54 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
55 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
56 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
57 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
58 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
59 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
60 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
61 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
62 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
63 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
64 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
65 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
66 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
67 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
68 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
69 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
70 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
71 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
72 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
73 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
74 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
75 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
76 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
77 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
78 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
79 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
80 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
81 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
82 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
83 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
84 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
85 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
86 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
87 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
88 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
89 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
90 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
91 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
92 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
93 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
94 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
95 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
96 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
97 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
98 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
99 A * 57888 Ben-Meir et al. 1/1/91 5,788,888
100 A * 57888 Ben-Meir et al. 1/1/91 5,788,888

INVENTOR

Inventor: Martin M. Lipp

Inventor: Steven J. Lipp

Attorney: or Firm: Lipp & Lipp LLP

ABSTRACT

A method in accordance with the invention for controlling the use of diagnostic or therapeutic instruments in interior body regions, includes a display of an image of the interior region at least the performing a diagnostic or therapeutic procedure on the image in sequence to the image.

9 Claims, 32 Drawing Sheets



15 US 6452615 B1

16 US 6424989 B1

17 US 6389311 B1

18 US 6385245 B1

US-PAT-NO: 6208353

DOCUMENT-IDENTIFIER: US 6208353 B1

TITLE: Automated cartographic annotation of digital images

----- KWIC -----

Detailed Description Text - DETX (34):

In a further application, a video sequence can be annotated after it has been recorded, e.g. as a travel log. In either case, when annotating a view of a video sequence, correspondence matching between cartographic and pictorial features can take advantage of a correspondence established for a previous view in the sequence. The previous correspondence can serve as an "initial guess" from which the desired new correspondence can be established by iterative refinement.

Claims Text - CLTX (14):

10. The method of claim 1, wherein the annotated image is one of a video sequence of images.

Details Text Image HTML KWIC

21 US 6289239 B1

22 US 6233590 B1

23 US 6208353 B1

24 US 6192266 B1

FIG. 7 is a flow diagram for matching and annotation in the method.

DETAILED DESCRIPTION

Using correspondence matching between cartographic and pictorial data, the pictorial data can be annotated with cartographic data.

As illustrated by FIG. 1, the technique includes the following procedural steps:

(a) based on given cartographic data 1 and viewer position data 2, extension of the viewer environment 3, i.e., of cartographic features which are visible from the viewer position

3
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;
the extension 3 is a set of cartographic features which are visible from the viewer position data 2;

move routine may be used to insert a synthetic object into a video sequence based on the pose and geometric information of calculate all other required object views of the synthetic object remaining frames using the pose and geometric information of the multi-view three dimensional estimation routine. As such object is inserted into the scene and appears as a "real" object imaged scene.

Claims Text - CLTX (11):

11. The apparatus of claim 9 further comprising: means for inserting a synthetic object into a frame of said video sequence where the geometry of said synthetic object is based on said computed of said frame.

Claims Text - CLTX (12):

12. The apparatus of claim 11 further comprising: means for inserting a synthetic object in a plurality of frames in said video sequence sizing said placed synthetic object based upon said inserted fr

Details Text Image HTML KWIC

14 US 6680976 B1

15 US 6600491 B1

16 US 6571024 B1

17 US 6553150 B1

18

United States Patent
Sawhney et al.

Patent No. US 6,571,024 B1
(4) Date of Patent: May 27, 2003

50 METHOD AND APPARATUS FOR MULTI-
VIEW THREE DIMENSIONAL ESTIMATION

51 Invention: Harpreet Singh Sawhney, Chubbuck,
NY (US); Robert Komer, Morrisville,
NC (US); Emilio Ciro,
Piscataway, NJ (US); Jatin Anand,
Piscataway, NJ (US); Keith James
Hanna, Princeton, NJ (US)

52 Assignee: Sunsoft Corporation, Princeton, NJ
(US)

53 Notes: Subject to any disclaimer, the term of this
patent is extended to adjusted under 35
U.S.C. 154(b) by 0 days.

54 Appl. No.: 09/204,631

55 Filed: Jan. 18, 1999

56 Int. Cl. G06K 9/32; H04N 13/00

57 U.S. Cl. 382/234; 382/236; 382/238; 382/240

58 Field of Search: 382/234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000

59 References Cited

U.S. PATENT DOCUMENTS

60 4,975,120 A * 5/19/98 Smith et al. 382/234
61 5,402,220 A * 12/19/99 Osherson et al. 382/234
62 5,402,220 A * 12/19/99 Osherson et al. 382/234
63 5,402,220 A * 12/19/99 Osherson et al. 382/234
64 5,402,220 A * 12/19/99 Osherson et al. 382/234
65 5,402,220 A * 12/19/99 Osherson et al. 382/234

OTHER PUBLICATIONS

66 C. Demetriou and T. Sauer, "Shape and Motion from Image
Sequences under Orthography: A Factorization Method", *Proc.*

US 6,571,024 B1
May 27, 2003

67 external Journal of Computer Vision (1992), 20, 27-37.
68 D. R. and J. K. "Robust Parameterization and
Computation of the Essential Matrix", *Image and Vision
Computing*, vol. 14 (1997), pp. 271-300.
69 Z. Zhang et al. "A Robust Technique for Matching Two
Uncalibrated Images Through the Recovery of the Unknown
Relative Orientation", *Artificial Intelligence* (1998), vol. 74,
pp. 87-110.
70 K. Nishino, N. Okuma, "Combining Pose and Motion
Analysis for Object Recognition of Video Sequences", *Proc.
Fourth Conf. on Computer Vision (ICCV'97)*, May 1998.
71 F. Tomasi, C. S. Geman, "Modeling and Edge Detection
Using Active Contours in Images", *IEEE Transactions on Pattern
Analysis and Machine Intelligence*, vol. 12, No. 6, 1990,
pp. 864-881.
72 S. Sapiro, R. Abeyaratne, K. Suen, R. Sengupta, "Multiscale
Model-Based Motion Estimation", *Proc. of European
Conference on Computer Vision*, vol. 2, May 12, 1992.

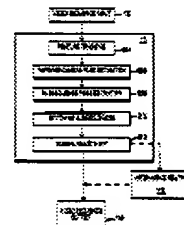
(See continued on next page.)

73 Primary Examiner—Bharat Mehta
74 Assistant Examiner—Karin Pohl
75 Attorney, Agent, or Firm—William J. Bruck
(97)

ABSTRACT

An apparatus and method for generating automated multi-view three dimensional pose and geometry information for the automatic of multiple and sequential views of particular objects into a real scene. A multi-view three dimensional estimation routine comprising the steps of feature matching, pose estimation, geometry estimation, computing camera pose by overlapping sequences and performing a global block adjustment to provide camera pose and scene geometry information for each frame of a scene. A match move routine may be used to insert a synthetic object into one frame of a video sequence based on the pose and geometry information of the frame, and to include all other required object views of the synthetic object for the remaining frames using the pose and geometry information required as a result of the multi-view three dimensional estimation routine.

13 Claims, 11 Drawing Sheets



EAST Browser - L5: [39] 1 with 4 | US 6538688 B1 | Tag: S | Doc: 18/39 | Format : KWIC

File Edit View Tools Window Help

telecine process

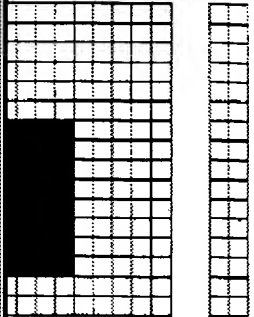
----- KWIC -----

Detailed Description Text - DETX (13):
A frame is composite if its odd and even fields contain pixel data from distinct images. This is the case for frame 400c of FIG. 4c. The even field of frame 400c contains the same pixel data as the even field of 400a. The odd field of frame 400c contains the same pixel data as the odd field of 400b. For this reason, frame 400c contains pixels data from two distinct images, the solid rectangle of frame 400a and the shifted, solid rectangle of FIG. 4b. Composite frames result when video sequence are transformed by a telecine process. Frame 400c is an intermediate frame that was inserted between frames 400a and frame 400b to adapt source video sequence 204 from a format having fewer frames per second (such as film) to a format having more frames per second (such as video). The telecine process creates frame 400c using the even field of frame 400a and the odd field of frame 400b. Since frames 400a and 400b include different images, frame 400c contains pixels data from two distinct images.

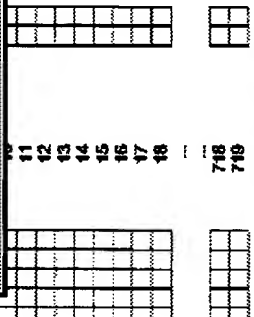
DetailsTextImageHTMLKWIC

16	US 6571024 B1	
17	US 6553150 B1	
18	US 6538688 B1	
19	US 6507618 B1	

1112131415161718718719



1112131415161718718719



correspond with Frame Position 2 (the beginning of the target Audio Window).

Detailed Description Text - DETX (155):

The replay portion of the video play sequence will always start after the ball has been taken out of play and no more new action pertinent to the game occurs. The replay portion of the play sequence will recap the current play while the players are entering their next game decisions. The replay will always continue to the end of the video play sequence. In this way, the final frame of every video play sequence will always be either in slow motion, a freeze frame or a graphics insert and thus provide a universal edit point back into the real time motion of the beginning of the next video play sequence and avoid visual or audible continuity problems with the edit. The end of the video play sequence will always edit to the next video play sequence with a wipe effect so that it psychologically brings the viewer back into real time without causing time disorientation.

Class: 8/1988 WFO
 Examiner—Jessica J. Harrison
 or Examiner—Kerry Owens
 Agent, or Firm—Burke-Robertson

ABSTRACT

An interactive live action football game which for example on a television screen. A play live action football game is provided which is an access storage and retrieval device and a dual, pre-recorded action football plays (film) of players of opposite teams. This information is random access storage and retrieval device according to type of play. The invention uses a microprocessor and microprocessor electronically associated with the random access storage and retrieval device. The microprocessor is used to enable one or more users to select in the control device, different football plays by type. A display device is electronically associated with the microprocessor to enable the selected play by the users. The microprocessor is further used to evaluate and cumulate play results as the users in a meaningful way. It is an object of the invention to provide an interactive, live game that can be played by one or more players or the like. It is a further object of the invention to provide such a television game which to select full motion video images, as opposed to graphics, to play such game and determine results.

19 Claims, 7 Drawing Sheets

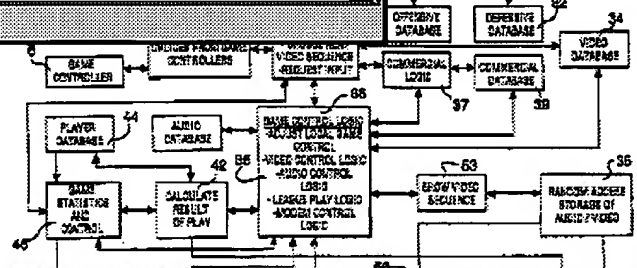
Details Text Image HTML KWIC

25 US 6137912 A

26 US 5695401 A

27 US 5462275 A

28 US 4724491 A



TITLE virtual objects insertion into video sequence of video frames - detecting two frames with same feature and detecting point subset in other frames, to site virtual object in defined place in both frames, select object reference points, computing position and inserting object in each frame

----- KWIC -----

Title - TIX (1):
Virtual objects insertion into video sequence of video frames two frames with same feature point set and detecting point subset in other frames, to site virtual object in defined place in both frames, select object reference points, computing position and inserting object in each frame

Standard Title Terms - TTX (1):
VIRTUAL OBJECT INSERT VIDEO SEQUENCE VIDEO FRAME POINT SET DETECT POINT SUBSET FRAME SITE VIRTUAL OBJECT SELECT OBJECT REFERENCE POINT COMPUTATION POSITION

Details Text Image HTML KWIC

34	US 20030076334 A	
35	US 6181382 B	
36	WO 9726758 A	
37	US 5481307 A	

WO 9726758

PCT/GB97/00015

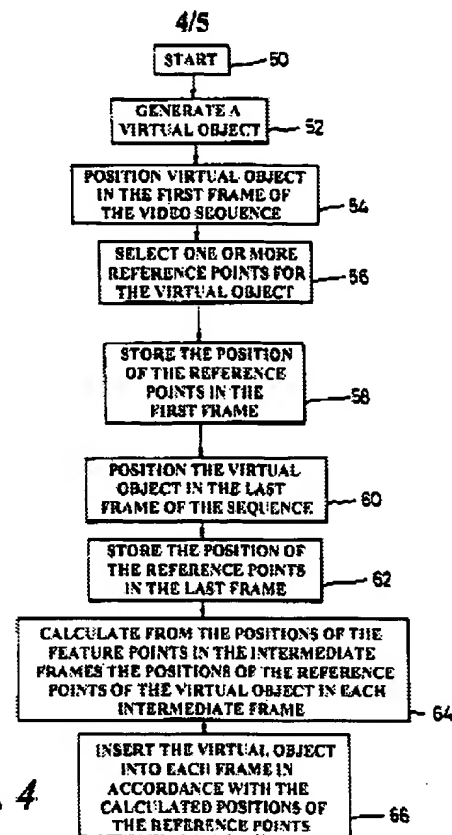


Fig. 4

SUBSTITUTE SHEET (RULE 26)

virtual objects insertion into video sequence of
frames - detecting two frames with same feature
and detecting point subset in other frames, to site
virtual object in defined place in both frames, select
object reference points, computing position and inserting
object in each frame

----- KWIC ----- ■

Title - TIX (1):
Virtual objects insertion into video sequence of video frames
two frames with same feature point set and detecting point subset
frames, to site virtual object in defined place in both frames, select
object reference points, computing position and inserting object

Standard Title Terms - TTX (1):
VIRTUAL OBJECT INSERT VIDEO SEQUENCE VIDEO FRAME
POINT SET DETECT POINT SUBSET FRAME SITE VIRTUAL OBJ
SELECT OBJECT REFERENCE POINT COMPUTATION POSITION

Details Text Image HTML KWIC

34	US 20030076334 A	
35	US 6181382 B	
36	WO 9726758 A	
37	US 5481307 A	

WO 9726758

PCT/GB97/00018

3/5

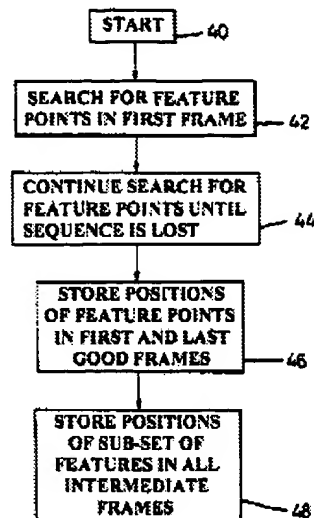


Fig. 3

SUBSTITUTE SHEET (RULE 26)

US-PAT-NO: 6559884

DOCUMENT-IDENTIFIER: US 6559884 B1

TITLE: Virtual studio position sensing system

----- KWIC -----

Abstract Text - ABTX (1):

Apparatus and method for inserting virtual objects into a video sequence including a camera position sensing system which uses LED's to provide perspective information for the camera sensing system thereby allowing natural scenery to be used.

Details Text Image HTML KWIC

11 US 6626117 B1

12 US 6578819 B2

13 US 6559884 B1

14 US 6381362 B1

4

1
 as covered by said detection device, is
 defined and used for defining the position of said
 one to the LED array.
 by the camera in a perspective manner.
 by the camera device comprising a detector cam-
 a portable device to be aligned with the
 aligned substantially the LED's are aligned
 a frequency outside the frequency range of the
 by said LED array light is a coded form, thereby
 of light source is an immediately identifiable
 by the LED's contained in a position in a fixed
 relative to a said scene.
 by the LED's are all positioned in plane or a
 plane.
 scene may be a scene captured once a background
 camera or may be an actual location.
 detected scene may be any natural or constructed

any of alternative scenes may be positioned in
 background scene, each camera being provided
 with scene.
 one invention also provides a method of deter-
 mination of a camera relative to a background, the
 tracking the scene of
 as a plurality of LED's in known fixed positions
 to the background, the LED's forming an array,
 the positions of at least a proportion of the
 relative to the camera or the camera array or
 position of the camera, and
 g the position of the camera relative to the
 scene.
 by the method further includes allowing in each
 array a specific code to thereby identify the LED
 the step of interrupting the output of each
 to identify the code.
 in each array comprises at least seven LED's,
 array each array comprises between 10 and 30
 more or less could be used for more complex or
 methods.

an environment the apparatus comprises a virtual
 an camera position system for a virtual studio,
 comprising a television camera providing a
 of a scene, an auxiliary detection device
 a said television camera, a plurality of light
 diodes (LED's) mounted in known fixed positions
 defined array within said scene and including
 detection means connected to said detection
 device, means comprising position sensing
 and for analyzing the perspective of the defined
 scene by said detection device, to provide a
 said one defining the position of said position
 one to the LED array and comprising a virtual
 object scene, a perspective transformation unit and a syn-
 the scene in which the position of said scene from the position
 sensing analysis means is connected to said perspective
 transformation unit to provide a transformed value, in
 which the virtual object scene is connected to said synthe-
 sis via said perspective transformation unit to transform the
 perspective and size of a virtual object to be inserted into
 said computer unit and in which the video output of the
 scene provided by said TV camera is connected to said
 computer unit and in which the computer circuit provides
 as an output a combined video image in which the virtual
 object is positioned in said scene.
 The invention further provides a method for positioning a
 combined video image comprising a real background scene

position of said LED.

The LED's preferably operate in the non-visible spec-

trum to be thereby non-detectable by a normal video camera.

The LED sources are detected by a detection system

mounted on a TV camera, the system formed by the LED's

being utilized to compare the position of the TV camera.

The present invention therefore provides a camera posi-

tioning system for a virtual studio, said system comprising

a camera, an auxiliary position device connected to said

camera, a plurality of light emitting devices (LED's)

connected in known positions to form a defined array and

including electronic detection means connected to said

detection device, said detection means comprising position

sensing analysis means for analyzing the perspective of the

object scene, a perspective transformation unit and a syn-

thesis unit in which the position of said scene from the position

sensing analysis means is connected to said perspective

transformation unit to provide a transformed value, in

which the virtual object scene is connected to said synthe-

sis via said perspective transformation unit to transform the

perspective and size of a virtual object to be inserted into

said computer unit and in which the video output of the

scene provided by said TV camera is connected to said

computer unit and in which the computer circuit provides

as an output a combined video image in which the virtual

object is positioned in said scene.

The invention further provides a method for positioning a

combined video image comprising a real background scene

----- KWIC -----

Method 1: The size of region 23 is definable in terms of geometric parameters. In this case the region is rectangular and has a width and height. In a first method the location of region 23 may be pre-determined within a selected video frame or a sequence of video frames by applying known geometric relational-dimensioning and known camera-angle and camera-position parameters. Software at editing studio 19 or the ISP in this method, having access to a geometric model of stadium 13 and all camera parameters is used to prepare metadata expressing one or more regions for later implanting of virtual content. The location and size of each region is ultimately expressed in terms of pixel locations (X-Y coordinates) within each video frame as viewed on a display. Region 23, as seen by viewers watching a video, will be a location within a selected sequence of video frames to which a virtual ad will be implanted according to an embodiment of the present invention.

already realized is a method and apparatus that tends to be impractical and at a user's expense in that the display may be more expensive, providing redundancy in achieving no added advantage, and so on a variety of details, such as degradation.

It is realized that such a system is capable of not only such that they may also share the same data and space as multiple images without color and size. That is, the use of an apparatus through they are not photographs in the sense as except in the traditional video presentation.

posed and different of the display hardware is providing visual interactive digital regions to machines is provided, computing an appropriate video presentation on a frame-by-frame basis. Motion sequences recorded in the network first in processing the video presentation at least one recording a sequence of video frames in the video data and a set of video frames in the video data in a sequence of frames, and a pixel sequence to a sequence of red, green, and blue (RGB) all of the pixels in the frame; then, the data also computing a specific deviation from the set of values, and at least one alternative video format is used based on the individual region in the sequence of frames; and the video data is used to generate a sequence of pixel values for the pixels in the individual integration sequence, in each frame of the video is received and processed, sets the pixel values of the video data, and the pixel values are used to generate a sequence of pixel values from the RGB average values based on the

12	US 6578819 B2	
13	US 6559884 B1	
14	US 6381362 B1	
15	US 6320624 B1	

ing the same color photograph in different geographic regions may have different side advertising labels, trademarks and captions, and so on. In this way, advertising may be more flexible and local, it is said, to a large viewing region.

The patent lawyers are aware of U.S. patents that also are to be issued over these regions defined as a viewing event originating in a location.

For example, U.S. Pat. No. 5,264,033, issued to inventor Roy A. Jones, et al. on Nov. 25, 1993 teaches apparatus and methods for detecting video content in video for an origination point, but do not go to interpretation as a downstream point in a manner that links moving images in the video transmissions to outside the virtual defined content to make the virtual content appear more real.

[illegible]